Early Challenges of Shifting an Australian Manufacturer's Utilisation of Design

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***Abstract*—This paper presents the findings from the initial exploration phase of an 11 month project, identifying the early challenges that a design innovation catalyst faces while initiating a shift in the way a medium sized manufacturing firm utilises design. Ultimately, the overarching aims of the project are to transform the utilisation of design within the participating company from a styling tool to a strategic process through the implementation of a design led approach to innovation. Insights were found through qualitative interviews with company staff and reflective journal entries as part of an Action Research methodology. Challenges identified include managing expectations, conveying the potential of a design innovation catalyst and a design led approach to innovation, and a siloed and risk averse culture. Findings presented in this paper will assist in identifying and understanding the preliminary challenges encountered by a design innovation catalyst when embarking on a design led transformation. Future innovation catalysts can prepare for possible barriers by highlighting considerations, opportunities and challenges when embarking on a design led transformation. Implications of this research are provided as possible approaches to overcoming these challenges.**

Keywords—design led innovation, strategic innovation, product styling, design innovation catalyst

I. INTRODUCTION

Historically, design has been considered a downstream activity in the innovation process; an afterthought applied to an idea to make it attractive, usable and marketable [1]. Certainly, utilising design at this level assists in increasing a product or service's desirability to consumers. The benefit of utilising design within a firm has been widely studied and is typically seen as a crucial precursor to innovation [2]. Furthermore, traditional design has been shown to improve the success of new product development [3]. This traditional application of design is prevalent in Australian manufacturing, an industry in which fierce overseas competition has triggered a steady decline over the past few decades [4]. In accordance with contemporary design research [5, 6, 7], this decline in performance serves to suggest that limiting the utility of design to simple aesthetics, ergonomics and materials would be to overlook its full potential.

Firms in the manufacturing industry are struggling to accurately understand and respond to their customers' needs, and consequently are experiencing continuing difficulties in differentiating their product offerings in an extremely overcrowded and progressively global marketplace [8]. As a result, many manufacturing businesses are attempting to become more competitive by shifting the way they utilise design: from a low-level styling tool to an integral strategic process [9]. Design led innovation (DLI) is a process that holds promise for this application by utilising design thinking in the wider and holistic context of a firm's business model and operations [6].

The aim of this paper is to present findings from the first four months of an ongoing 11 month study within an Australian manufacturing small to medium enterprise (SME). Embedded within the participating company, the first author has been employed as a change agent or 'design innovation catalyst' [10], henceforth referred to in this paper as a catalyst, to demonstrate a design led approach to innovation with the purpose of facilitating a beneficial shift in the utilisation of design. Wrigley & Bucolo [10] describe the role of a catalyst as someone who "*continuously instigates, challenges and disrupts innovation internally and externally from within the company, whilst re-aligning and mapping these activities back to the strategy of the business*" (p. 921).

Over the duration of the overarching 11 month embedded project, the catalyst aims to facilitate a company-wide shift in the utilisation of design, from a styling tool to a strategic process. This larger study will investigate the overall barriers, challenges and value of this shift. Findings from the first four months of this project are presented in this paper and will assist in understanding the preliminary challenges encountered when embarking on a design led transformation. Hence the research question addressed by this paper is: '*What are the early challenges involved with initiating a shift in the utility of design within an Australian manufacturing SME through the*

introduction of design led innovation?' Specifically, this paper will examine these challenges in relation to a business that has traditionally utilised design as a styling tool and which is already involved in other organisational transformation processes. Implications of this research are provided as possible considerations when attempting to overcome these challenges.

II. Literature Review

A. Australian Manufacturing SMEs

Similar to most westernised countries, the share of GDP contributed by manufacturing in Australia has been declining over the past thirty years [4], primarily due to fierce competition and price undercutting from overseas competitors [8]. Despite this weakening within the industry, manufacturing remains a significant part of the Australian economy, contributing approximately 9% of GDP during the financial year ending 2010 [11]. In 2004, manufacturing was the fifth largest employing industry in Australia, behind agriculture, construction, retail and property/ business services [11]. In addition to a highly competitive market, the Australian manufacturing sector faces a range of challenges, in both the short and long term. Immediate restrictions identified by the Industry Innovation Council [8] include carbon emission requirements and rises in the exchange rate of the Australian dollar. Furthermore, ongoing challenges such as globalisation, an ageing workforce and a relatively small domestic market are also putting pressure on the industry [8].

Many of the problems faced by the manufacturing industry are often amplified due to most of Australia's manufacturing firms belonging to the SME sector. Typically employing between 20 and 200 staff, SMEs make up as much as 88% of the manufacturing industry and 99% of Australian businesses in general [12]. In a non-industry specific sense, small and medium sized businesses often face a distinctive set of challenges such as a lack of market influence and susceptibility to economic turbulence [13]. Evidently, manufacturing SMEs in Australia face a unique combination of challenges and opportunities.

A study by Bohemia [5] found the three most important reasons Australian manufacturers employ designers to be: (i) Increase appearance of the product; (ii) Increase product quality; and (iii) Increase production efficiency. Employing a designer to be an 'integrator of various functions', including strategy and process, was found to be one of the least common reasons [5]. These findings reflect the traditional perception of design adopted within the manufacturing industry that has hindered radical innovation in recent years [14]. Due to these trends in the industry, it is becoming increasingly more important for the Australian manufacturing sector as a whole to innovate at a strategic level in order to compete in a global economy [15]. Utilising design as a strategic business resource holds promise for this application [7, 16, 17].

B. Design as Business Strategy

Increasingly, forward thinking companies are realising the potential for design to assist in the innovation process itself, and add strategic value to the overall business [7, 16, 17]. The Danish ladder of design (Fig. 1) illustrates four levels of design integration in to which a business could be categorised: (i) no design, (ii) design as styling, (iii) design as process and (iv) design as strategy [18]. A growing body of peer reviewed literature exists which exemplifies and justifies the benefits of integrating design as a core strategic device within a business [1, 7, 10].

Neumeier [19] recognised differentiation as the most powerful business strategy in a cluttered market and succinctly describes the relationship between these concepts: design drives innovation and innovation drives differentiation. This relationship describes, at a fundamental level, how design can be engaged as a means to influence business strategy. The process of employing design as a strategic tool is described as design led innovation [16], design driven innovation [7] or design integration [20]. In essence, design led innovation is the process of utilising design thinking in the wider and holistic context of a business's innovation strategy, with the aim of adding value to the overall business and its stakeholders [16].

A traditional, linear design process is congruent with a typical business structure, as it can be monitored and measured by managerial staff, in the same way that other functions of a business might operate [19]. Design led innovation, on the other hand, operates at a broader level; it encompasses all aspects of a business by iteratively visualising problems and ideas from different perspectives [6]. This ability to shift perspective on a scenario is referred to as reframing; a capability inherent within design and a key component of the conceptual Design Led Innovation Framework [15].

The conceptual Design Led Innovation Framework (Fig. 2) illustrates an iterative process that can assist companies to explore, capture and realise the strategic value that design can bring to a business [15]. Central to this process is the opportunity or value proposition that is informed by all aspects of the business. Starting with the observation stage, the firm considers its customers at the commencement of the design process by identifying its complete value chain. In the context of this framework, reframing is used to identify and understand the meaning behind observations. These informed insights can then be used to structure the central opportunity to create a new value proposition. At this stage it is possible to develop a new competitive strategy that can then be prototyped and tested with stakeholders, in order to review and challenge the existing brand message.

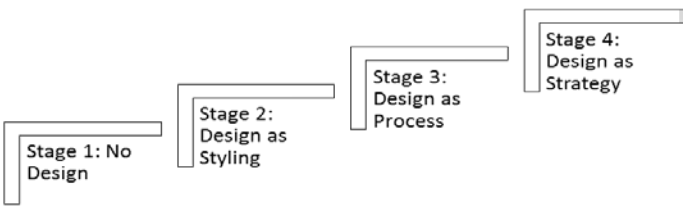

Fig 1. Danish Ladder of Design [18]

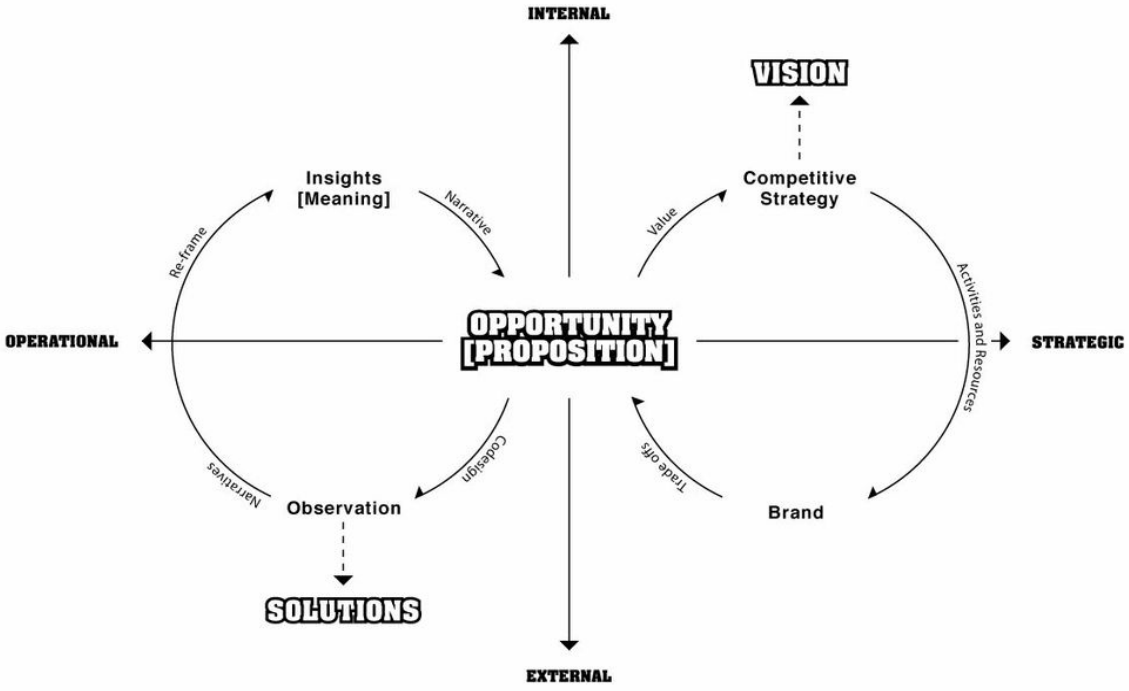

Fig. 2. Design Led Innovation Conceptual Framework [15]

C. Design Innovation Catalyst

The concept of a design innovation catalyst is relatively new and was first introduced in literature in 2012 by Bucolo & Wrigley [10]. The proposal of a catalyst challenges the traditional role a designer plays within a firm by building upon Norman's [21] 'transitional engineer' concept. Norman [21] recognised the need for a multidisciplinary authority that could bridge the gap between research and practice in the field of product development. It was proposed that this gap exists due to distinctive differences in skills, knowledge and semantics between researchers and practitioners [21]. Design led innovation, as an integrative process between design and business, encounters similar issues in bridging the gap between operational and strategic activities [10]. This is where the catalyst is required: a practitioner who can effectively "*translate and facilitate design observation, insight, meaning and strategy, into all facets of the company*" [10, p. 921]. This role is illustrated in Fig. 3, where the purpose of the catalyst is mapped over the design led innovation Conceptual Framework. Fig. 3 shows how the catalyst operates at both a project level and a business level, while constantly assessing and prototyping ideas against the company's core value proposition [22]. Among other valuable characteristics, visual communication skills and a strong sense of empathy make designers well suited to this purpose [15].

D. Organisational Change

Although the manufacturing industry is a significant contributor to the Australian economy, firms in this sector are becoming increasingly less competitive in the global marketplace. Because of this, government incentives and policies which focus on improving innovation and research and development within the sector have been put in place to allow firms to restructure and reinvent themselves [8]. A firm's ability to accurately identify its future direction and manage the changes required to get there is critically important [23]. Hence a broad understanding of organisational change and its proper implementation is necessary for individual firms in the industry.

Organisational change was defined by Moran & Brightman [24] as *"a process to continually renew an organisation's direction, structure, and capabilities to serve the ever-changing needs of external and internal customers"* (p. 111). A study by Wiesner, Banham & Poole [25] found that SMEs engaged in organisational change with the intent of improving more than just service to customers. In their research, change was pursued in SMEs in order to advance business aspects such as competitiveness, communication, decision making, and labor flexibility [25]. However, McAdam, Keogh, Reid & Mitchell [26] suggested that change programs such as innovation interventions are not suited to a SME context. Primarily this is due to differences in human, financial and capital resource availability, when compared to larger corporations [26]. Wiesner, Banham & Poole [25] proposed that traditional, large scale business development processes are often applied in SMEs despite being fundamentally unsuited to a SME context. In order to achieve effective change and business development in a SME, a process is required that considers the unique features and constraints of a SME [25]. Features to be taken into account include a greater level of flexibility, flatter business structures and less formal management arrangements [26].

Leadership is a highly influential factor of managing change within an organisation [25]. Specifically, leadership commitment is essential for both motivating change and implementing it [24]. Similarly, Wiesner, Banham & Poole

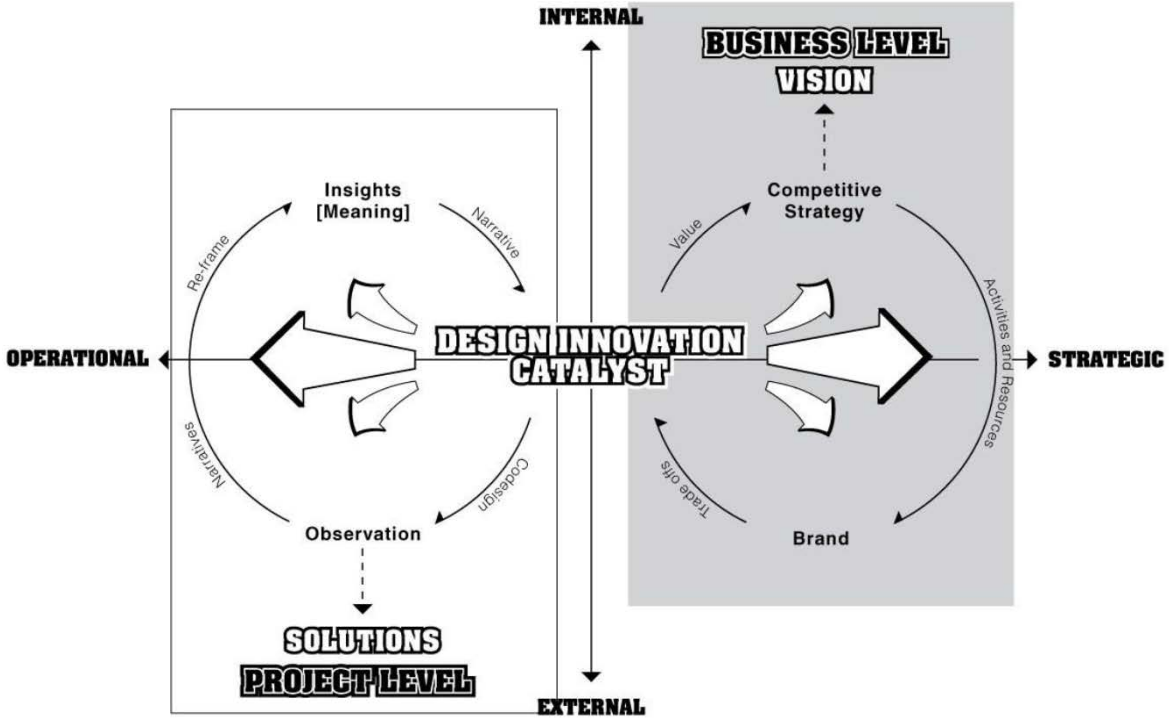

Fig. 3. Design Innovation Catalyst Framework [10]

[25] proposed that very little change can be achieved without strong leadership. Similar to the role of leadership, corporate culture can have a significant impact on the effectiveness of organisational learning practices, and therefore also influence organisational change [27]. Literature reviewed by Wang & Ahmed [28] suggests that a traditional hierarchical leadership culture is counterproductive to organisational learning. Instead, a collaborative team culture in which all members of the organisation can positively contribute has been proposed as a more effective approach to organisational learning [28].

III. METHODOLOGY

A. Research Design

This study has been built around an Action Research methodology, defined by Zuber-Skerritt [29] as a reflective and iterative research process conducted through dynamic involvement and engagement with the subject. Action Research *"seeks to bring together action and reflection, theory and practice, in participation with others, in the pursuit of practical solutions to issues of pressing concern to people"* [30, p.10]. This method of research is particularly appropriate to this project as it allows the embedded catalyst to proactively disseminate knowledge, facilitate learning and incite change within the participating company, while simultaneously reflecting on the outcomes and barriers encountered. Action Research effectively bridges the gap between academia and industry, facilitating rapid testing and evaluation of theory-based proposals in a real world context [31]. The findings presented in this paper have been gathered from the combination of two distinct data collection methods within the Action Research process: semi structured interviews and reflective journal entries.

B. Participating Company Background

The company involved in this research is a prominent manufacturer and supplier to the window fixture industry, dealing with products such as blinds, awnings and shutters. Having grown from a small family business, the company now employs approximately 160 employees across several locations in Australia and New Zealand. Traditionally, the firm has been a longstanding and respected designer, manufacturer and supplier of these products. A monopolistic control over the Australian market saw immense growth during the 80s and 90s. Riding on this success, the company invested heavily in capital and real estate, creating an extremely stable platform for the business to persevere financially through economic turbulence. However, continued reactiveness to the market and the introduction of few new innovations has seen a steady decline in market share over the past decade. Increasing difficulty to manufacture locally at a competitive price point has seen the downsizing of some manufacturing processes as well as many being moved offshore in recent years.

The participating firm has historically valued design as a styling tool, used within the research and development department as a means to develop the functionality and usability of products. This level of design utilisation is typical within the industry [5] and corresponds to Stage 2 on the Danish Ladder of Design (Fig. 1) [18]. Evidently, there is potential for the participating company to benefit greatly from shifting the utilisation of design up the ladder, ideally to a level of strategic integration.

C. Data Collection

Twelve semi-structured interviews were conducted individually with twelve staff members, three months into the company engagement. The interviews ran for a typical duration of 30 to 60 minutes in a private, face-to-face and one-on-one setting. The interview questions explored the participant's understanding of design and the perceived relevance of design led innovation to the company. The interviews also discussed perceptions of the primary researcher's role as a catalyst: its potential impact, merits, outcomes, and thoughts of what the role would involve. Example interview questions include "*In your opinion, what is the role of design within [company]?", "How would you describe [company]'s innovation process?", "Do you think this project is relevant?*", and "*What do you consider my role to be within [company]?"*. Ethics consent forms were completed by each participant prior to the interviews, and all participants gave permission to be voice recorded for later transcription.

In addition to interviews, a reflective journal [32] was utilised by the first author as a means to record and learn from employee's reactions and responses to events involving the researcher. Daily entries included reflections on design led innovation workshops, conversations with staff, presentations, interviews, meetings and general day to day work.

D. Participants

Interviews were used to capture knowledge and understanding of design within the participating company. To maximise the relevance of interview discussions, participants were selected based on their influence within the company, their knowledge of the company, their awareness of innovation, their relationship to this research project and their accessibility. Due to these selection criteria, most participants were in supervisory or managerial roles. These criteria are summarised in Table I below, in order of significance.

E. Analysis

A thematic analysis [33] of the interviews produced a range of insights that reflect and substantiate the first hand experiences of the primary researcher from the company's perspective. Three key themes emerged: misinformed expectations, conveying relevance and restrictive corporate culture.

TABLE I.

Participant Selection Criteria	
Criteria	***Description***
Company Influence	Nodal staff within the company were targeted primarily, such as managers and supervisors
Company Knowledge	Staff in collaborative positions and staff with a long history in the company
Innovation Awareness	Staff in positions that consider design, innovation and strategy
Relation to Project	Staff who are working closely with the catalyst
Accessibility	Staff who are available and contactable by the researcher

Outcomes from the interviews were presented back to staff, from which reactions and comments were recorded in the reflective journal. To begin the analysis of the transcripts and reflective journal, key words and phrases were coded and comparatively referenced between the two data sets. Commonalities between these data sets were simplified to the core ideals and attitudes behind the statements or references. From this, the three core themes and multiple sub themes were identified in order to inform the results and discussion of the research [33]. These themes and associated findings are discussed in the Results section below.

IV. Results

Through the thematic analysis, three key challenges to initiating a shift in the application of design from a new product development focus to a 'whole firm' strategic focus were identified. Firstly, preconceptions and expectations of the role of the embedded placement were misinformed. Secondly, conveying the relevance and potential of a new approach to innovation was necessary in order to differentiate these processes from the work of consultants previously employed by the firm. Thirdly, the company culture was perceived by staff to have inhibited the adoption of new innovations in recent years. These three predominant themes represent the main challenges faced by the catalyst in the early stages of this study, and are discussed in detail.

A. Managing Expectations

The first and most immediate challenge faced by the catalyst was managing and overcoming the initial expectations of the role from the firm's perspective. Principally, there was a general lack of knowledge of the role of the catalyst, which generated a misconception of the scope of the role. Initially, the position was commonly assumed to be similar to an in-house industrial design work experience placement. There was an understanding that the position would be mainly self-directed however, as explained by Participant 4:

"Your role is whatever you want it to be. My first thoughts were industrial designer. From an aesthetic point of view, look at the aesthetics of some of our products and systems. I don't know why I was thinking this; my thoughts were that it's about looking at our current products."

Initially, the potential of a role focused exclusively on design integration was misunderstood and for the most part not considered as the purpose of the catalyst's employment.

From the company's perspective, the catalyst's background in industrial design overshadowed the potential of a position which focused more on facilitating a strategic approach to innovation: *"We thought oh, if he's an industrial designer, he must design"* (Participant 2). Although an industrial design perspective was perceived by staff to be a valuable asset to the research and development department,

the full potential of an embedded designer was not understood, even at a product focused level of design. As exemplified by several participants, industrial design was perceived to be largely involved with improving the visual appeal of a product: *"Engineering is not perfect for developing the looks of a product, we only know about the functionality, so we were hoping to get your input on this"* (Participant 1).

Discussions had been conducted within the Research and Development department prior to the embedment with a focus on outcome expectations for the researcher. However, these discussions had taken place under the previously discussed assumptions of the role, where it was understood as an Industrial Design work experience position. Because of this, perceived outcomes were mainly focused on potential contributions to short term projects which were currently under-resourced: *"Initially before we bought you over, we had a plan where you would become an independent who could deliver solutions for a couple products where we can't afford to spend too much time"* (Participant 1). Day-to-day task requests were often unrelated to the actual work of the catalyst, and on occasion even unrelated to design.

B. Conveying Relevance and Potential

Following the clarification of what does not constitute a Design Integration position within the firm, a challenge was identified in conveying the relevance and potential of such a role. Initially, the catalyst's approach to knowledge dissemination with regards to design led innovation theory, processes, case studies and potential outcomes was unfocused. Presentations and workshops were typically run with accessible staff in small groups. However, higher levels of engagement, questioning and understanding were found to be achieved through one on one consultation with employees.

In a product focused department, non-tangible outcomes such as research, strategy and process proposals are often prioritised behind more urgent and 'direct value' projects. In most cases, interviewees had not yet become engaged with design led innovation, and still considered design outside a product focus to be very separate to their own work. As noted by Participant 4, *"Well that's it; it's not a tangible thing like here's a new [product]. But that's sort of the way a lot of people would look at [your project]."* There was a strong mindset within the firm that a clearly defined end result and outcome would be necessary in order to achieve active engagement, as noted by Participant 5:

"They need to see it. So you can say this is a way to do it but they'll always ask what is the end result. What can we get out of it? So for you to make an impact, you'd have to say this is how you do it, this is how you could do it, here's a specific example of exactly how it can make a difference".

Prior to the commencement of the project, a company representative was chosen who would supervise the project, known as the 'design champion'. The design champion held a perspective of the design-led project that it was primarily university focused, with outcomes mainly applicable to research and not to practice: *"So you'll have to deliver some side things to make it worthwhile… It's getting back to direct value … whatever it may be, to support some of the things we are doing now"*. Without the initial engagement from the design champion, the project was driven exclusively by the catalyst. Independently delivering outcomes and continually refreshing the relevance of these outcomes to the company was found to be an effective way of demonstrating value to the design champion and other employees.

Due to the catalyst's position being based in the Research and Development department of the participating company, almost nothing was known about the design-led initiative in other departments of the company. Without the issue of overcoming preconceptions and expectations, creating an understanding of the scope of the position to areas such as sales, marketing and operations was much less of a challenge. However, setting aside time to discuss a relatively long term and strategy-based project was difficult for some staff. Many employees were perpetually busy with the immediate task at hand. In some cases, staff were unsure of the realistic potential of a catalyst position within the firm. For example, doubts were expressed by Participant 9: *"I think it depends what you want to get out of a consultant. I'll call you a consultant because it's similar. Consulting will never change what you do, they'll never change your culture. But what they do is make you think about it and put up arguments."* In addition, a comprehensive, company-wide strategic plan had recently been approved prior to the start of the catalyst's engagement. This timing created difficulties in initiating a strategic shift while aligning with similar past work by external consultancies. Demonstrating the differences of design led innovation to these previously run business development programs was found to be an effective way of minimising such difficulties.

C. Siloed and Risk Averse Culture

There was a general perception that internal departments of the company were often too separate: *"But there are times there when we get in our own little world and don't worry about other areas. We forget about them. And we're all at fault for that"* (Participant 6). Despite recognising the issues caused by this separation, principally a barrier in communication, the difficulty of implementing a solution seems to have restricted any effective change. The poorly perceived communication within the firm appeared to be a common frustration with many of the interviewees. One interviewee suggested routine as a cause of communicative barriers: *"I think that's why some of the communication is not so good, because people don't go through the right processes. They just do things the way they've been done"* (Participant 5). Communication issues were also experienced by the researcher, and proved to be an ongoing challenge to gaining traction with design integration.

Many staff made reference to a negative cultural shift within the firm over the past decade. Commonly, this was attributed to the change from a family-based management to corporate management. Participant 7 articulated this cultural shift: *"When the family were running it, it was family orientated, it was friendly. You felt part of something. Whereas now it's become corporate, which it doesn't need to be."* Participant 9 made a similar comment, stating *"I don't*

think we've got as good customer relationships as we had when the business was run by the family. Because I think that was more of a nurturing environment rather than a corporate environment." Also reminiscing of 'better times', Participant 10 talked of how the company experienced great success in a past marketplace:

"Because the business grew up in a time where demand was limitless and we just couldn't supply enough, the approach to something new was based on launch it, see what happens and then we'll modify it based on feedback. People just accepted that that's the way it was, and the market worked around it".

From the embedded researcher's perspective, departments of the company seemed to have misaligned expectations of each other. Either miscommunicated or misinterpreted, differences in some expected deliverables are evident in the following quote by Participant 5: *"Even though they say they want to focus on innovation, I'm sure they do, but a lot of times you find when you do bring something new to the table, if no competitor has it, then they don't want to take it on. Which I think is like the opposite of what you want to do"*.

Further to the previous quote from Participant 5, many interviewees expressed awareness of a tendency within the company to avoid the implementation of potentially risky new products and services in recent years. Participant 9 considered this to be a problem within the industry itself: *"I don't know what it is but in this industry, people are quite happy not to change. And that goes down to our customers as well"*. This conservative nature has contributed to a general perception that the firm holds a reactionary place in the market. Almost all participants recognised a reactive, rather than proactive approach to innovation with the company: *"The processes are there, but they need to be tailored in such a way that they are more proactive, rather than lethargic, at best, in their approach"* (Participant 2).

V. DISCUSSION

The results presented in this paper offer potential considerations for a design innovation catalyst during the initiation of a design-led transformation project within a manufacturing SME. Some findings draw similarities with the literature of manufacturing SMEs previously reviewed. Upon commencing the project, the catalyst's role in the company was, to a large extent, misunderstood within the research and development department. However, the preconceptions of the position were congruent with literature on design's historical value in manufacturing. The participating company's initial expectations of the catalyst's role closely resembled the ways in which manufacturers have traditionally valued industrial design, as described by Bohemia [5]: a dominant focus on aesthetics and product quality. It would seem that the greater potential of design as a strategic process [1, 5, 7] is only beginning to be recognised in industry. Because of this, it is important that any company taking on a design led transformation is aware of what to expect from a dedicated strategic design operative. For example, it is important that the company perceives the catalyst to be working with them, rather than for them [22]. In the case of the company participating in this research, it is possible that this awareness did not permeate throughout the department due to the poorly perceived level of internal communication identified by staff during interviews.

Many innovation interventions are not suited to the SME context [26]. Some of the challenges encountered by the catalyst are reminiscent of the barriers to innovation adoption discussed in SME literature. For example, it is suggested that staff in SMEs are often used, officially or not, in a multi role capacity. For the participating company, employing an innovation-specific role is contrary to this practice. This contributes to explaining the somewhat varied 'work experience' related outcome expectations initially planned for the catalyst. McAdam, Keogh, Reid & Mitchell [26] also recognise that the time required to provide 'innovation training' to SME employees is often difficult to acquire. This was certainly the case in the participating company, where a strong and perpetual focus on the immediate task at hand made it difficult for some staff to set aside time for discussions, interviews and workshops with the catalyst.

It is possible that a greater awareness of the strategic value of design from the firm's upper management would assist the catalyst in overcoming issues with staff engagement. Moran and Brightman [24] proposed that disseminating a vision for change throughout the organisation is critical in order for a firm to successfully initiate change. These authors go on to recommend that strong leadership capabilities within the management team are possibly the most effective way to achieve change. Wrigley [22] presented a similar notion in regards to design led innovation, stating that a design led approach obligates a top-down commitment in order to be universally adopted within a firm. In the participating company however, the design led transformation was not being driven from the upper management, but was instead being pushed from a project level, almost exclusively by the catalyst. Since company staff were unaware of the value of design to strategy, they were unaware of the potential of the catalyst to influence strategy. This lack of knowledge of the potential of design for strategy could go some way to explaining the difficulty and sluggishness of staff engagement.

Some staff expressed doubts as to the overall potential of a catalyst position within the firm due to a perceived lack of change from previously undertaken innovation workshops and work with external consultants. Because of this, there was a strong need to demonstrate the differences between a design led innovation approach and the processes they had employed in the past. Wrigley [22] noted that a design led transformation is not achievable through outsourcing to external entities such as consultants or analysts. Therein lies the advantage of a catalyst and the primary difference between design led innovation and external consultant work: a design-led transformation is, at its core, a cultural shift, and must come from within the firm [10].

Although not specifically mentioned by any interviewees, it is likely that, due to internal cultural change over recent years, the participating company has been less able to keep up with the rapidly changing market. This has fostered a culture that is somewhat 'stuck in the past' and not future focused. The focus on radical and proactive innovation present in

design led innovation contrasted greatly with the existing modes of thinking prevalent within the firm. It is possible that this reactive culture, in addition to a lack of strategic design awareness, prevented the prompt uptake of design led innovation throughout the company. Moran and Brightman [24] reason that in order for a person to positively engage with change, the change itself must align with the person's sense of purpose. Extrapolating this to an organisational sense, change programs must consider the firm's core values and beliefs in order to achieve company engagement. The Design Innovation Catalyst Framework (Fig. 3) shows how the catalyst achieves this by continuously considering and relating to the firm's central value proposition. This link between initiating change and relating to purpose could explain why a higher level of engagement was experienced through workshops that investigated the company's 'why' or purpose.

VI. IMPLICATIONS

The implications of this research are tentative and are presented as proposals for future investigation. At the time of writing, the implications discussed below are still being tested and their full benefits are still emerging.

In order to facilitate and encourage a valuable contribution from the catalyst, discussions prior to the engagement about desired outcomes and expectations should be conducted with input from various departments of the company, and should involve the catalyst themself. As the work of the catalyst is not confined to a single area of the business, the inclusion of staff from different departments in these discussions could assist in developing collaborative expectations. Involving the catalyst would increase the likelihood that the expectations are informed and relevant to the integration of design as a strategic process.

Without a strong understanding of strategic design among the upper management of the participating company, initiatives were driven almost exclusively by the catalyst from a lower level in the company. It would seem that in order to accelerate the implementation of design led innovation, gaining buy-in from managerial staff should be an initial and necessary focus of the catalyst. However, results presented in this paper suggest that it may be more feasible for the catalyst to focus on engagement with interested employees, regardless of their position within the firm. Using this approach to secure a foothold within the company could be an effective precursor to achieving buy-in from top line management.

Cultural barriers within the firm have hindered the adoption of design led innovation processes. In order for the catalyst to effectively initiate change, it is important that the company's core purpose is first identified. Engagement with staff can then be encouraged by continuously reiterating the relationship between the catalyst's work and the company's value proposition. However, findings from this research suggest that this initial level of engagement may not be enough to drive an actual shift in thinking due to prejudices from past business improvement initiatives. Highlighting the differences in adopting a design-led approach could help to overcome biases and move away from the idea that it is just 'another development program'. Additionally, building upon past initiatives, rather than 'starting from scratch', shows potential to capitalise on previous levels of engagement and outcomes.

The proposed implications of this research are relevant from both the perspective of the design catalyst and the firm itself. Table II below summarises the previously discussed implications accordingly.

VII. SUMMARY

This paper presents findings from the initial engagement and exploration phase of an 11 month research project with the intention of identifying the early challenges faced by a design innovation catalyst while initiating a shift in the way a manufacturing SME utilises design. As an embedded catalyst, the findings of the first author reflect some of the challenges and barriers that may be experienced while attempting to operate within a manufacturing company that is not entirely aware of the potential of such a role.

It was found that the position was not well understood and its value was initially misinterpreted. Following this, challenges were identified in effectively communicating and demonstrating what outcomes could be expected by the catalyst, and how these outcomes would fit in with existing business strategy. At a more general level, barriers to initiating a design led approach to innovation were identified in the often siloed and risk averse culture of the participating company.

The previously summarised implications of this research are proposed for future investigation and can be interpreted from two perspectives. Firstly, the results highlight considerations for an embarking catalyst, providing a foresight

TABLE II.

Tentative Implications of Research	
Catalyst – Considerations when initiating a design led project within a manufacturing firm	***Industry*** – Considerations when taking on an embedded catalyst
• Insist on collaborating with the company when specifying expected outcomes prior to commencement • Initially focus on engaging staff regardless of position within company – buy-in from upper management will follow • One-on-one discussions with staff create a greater level of understanding • Demonstrate how DLI will benefit and integrate with existing company strategies by aligning the vision for change with the company's core purpose • Demonstrate the differences between DLI and past change programs, build upon previous work rather than starting from scratch • Reiteration of vision alignment and DLI 's points of difference is key to keeping strategy front of mind	• The role of the catalyst is inter-departmental • Involve staff from different departments as well as the catalyst when specifying expected outcomes of the project • Endeavour to work alongside the catalyst; innovation cannot be seen as an alienated responsibility • Endeavour to remain open minded towards theory introduced by the catalyst • Dedicate time and resources to long term and future focused collaboration, discussions and workshops

to the challenges they might encounter and allowing them to pre-empt possible solutions to these challenges. Secondly, the insights discussed in this paper present opportunities for manufacturing firms to be better prepared to facilitate and engage with a newly appointed design innovation catalyst. Future research will build upon these implications, identify challenges experienced in later stages of the design led transformation, and examine effective ways of overcoming these barriers.

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